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A GLACIAL HANDBOOK.

Ice-Work Present and Past. By T. G. Bonney, D.Sc., F.R.S., &c. Pp. xiv + 296. (London: Kegan Paul, Trench, Trübner, and Co., Limited, 1896.)

THIS latest addition to the familiar red volumes of the International Scientific Series is in many respects a model of what we may take to be the aim of the whole series. An exposition of the results of modern research and modern thought, which shall be of an unrestricted and international character, written without offence to prejudices or persons, is no mean task for an author to set before himself. And when the subject approaches the chilling atmosphere of the ice-age, we know how frequently the scientific soul waxes warm, and fortifies itself towards the inevitable conflict; while the outer world exclaims,

> "That is hot ice, and wonderous strange snow."

Has it been left for Prof. Bonney to "find the concord of this discord"?

The aim of the author in this instance is to give prominence "to those facts of glacial geology on which all inferences must be founded." He begins most appropriately with a description of a "gathering-ground of glaciers" in the Bernese Oberland, a scene as familiar to himself as Bedford Square or King's Parade must be to many of his readers. A sober restraint is put upon his powers as a word-painter, and we have a condensed account of ice and ice-work in Switzerland, crisp and clean as the surface of the snows themselves. It is true that the irrepressible faculty of imagination breaks out occasionally, seeing more before it than the upturned face of the student; and the contrast is almost too abrupt, it betrays the effort at conciseness. Thus we are uncertain whether the "struggle of Solferino" (p. 35) refers to a meeting of descending glaciers, or to the events of recent history, since all the other references in the sentence are to purely geographical features.

In this first chapter, certain conclusions are drawn from the facts described, but so delicately and naturally that they seem to involve no controversy. A confidence is thus established between us and the author, and we follow him with the secure feeling that theories may be suggested, but will not be thrust upon us. If a writer has formulated any opinion of his own, this is the very happiest method of securing a hearing for it.

The second chapter deals with the larger phenomena of arctic and antarctic regions. To some extent this traverses the ground of Prof. Wright's corresponding chapter in "Man and the Glacial Period"; but additional matter is introduced, even in dealing with Alaska. Attention is very properly drawn to the feeble character of the "ground-moraine" in areas covered by an ice-sheet, and to the great accumulation of the materials, in the form of a terminal moraine, as the glacier retreats, when they become (p. 48) "drawn very gradually, like a coverlet, over the bed of the valley." On p. 57, another point of first importance is set down with characteristic delicacy; "it is therefore obvious that in all speculations as to the condition of any region during the Glacial Epoch, account must be taken of the possibility of a not inconsiderable difference in either direction from its present level." The evidence bearing on this subject has been so freely overlooked by those who have felt it easier to accept enormously thick ice-sheets, rather than differential earth-movements, that this innocent little sentence suggests in reality a controversy ranging over both the hemispheres.

The description of the Malaspina Glacier near Mount St. Elias in Alaska, quoted from Mr. Russell, naturally forms the most interesting feature of this chapter. The term "Piedmont Glacier" (p. 68), as it happens, would have been explained more clearly in Mr. Russell's own words. Since the date at which Prof. Bonney wrote this account of the Chaix Hills, with their uplifted marine glacial gravels, he has examined the additional evidence of post-glacial elevation brought forward by Colonel Feilden from Kolguev Island (*Quart. Journ. Geol. Soc.*, London, vol. lii., 1896, p. 57).

After this review of "existing evidence," Part II. describes the "Traces of the Glacial Epoch." The discussion of the origin of lake-basins is concerned with the greater lakes of the world, and the summing-up is in favour of their hollows having been caused by earth-movements. Eskers are dealt with in the same chapter, and the accumulation of sands and gravels in the very areas claimed by some authors as regions of excavation is, in conclusion, neatly pointed out. After Mr. Russell's description, quoted on p. 74, we are left somewhat in the dark (p. 116) as to the probable origin of eskers. The names of Hummel and Holst might well have been quoted in connection with the theories for which they are respectively responsible; and Ireland is so eminently a land of eskers, that one is inclined to ask for a view or section of an esker of home-manufacture, instead of the figure from New Hampshire given us on p. 110.

Why, again, in the next chapter, headed "Ice-work in Great Britain and Ireland," is till illustrated from "Seattle, Washington State," except for the fact that Prof. Wright's block is in the possession of the publishers of this series? All through, Prof. Bonney has been somewhat badly treated in the matter of illustrations. The Alpine drawing in Prof. Wright's book is painfully rigid and antique, and we should consequently have welcomed a photographic view of the Aletsch Glacier to illustrate Prof. Bonney's description. The frontispiece, showing the results of ice-work, is the only novelty of the kind. Even the scratched blocks figured are not from Finchley, or Snowdon, or Glencullen, but from "the till of Boston," which seems far away from an English author, even in an international scientific series.

Such drawings as are given had a special interest when put before us by Prof. Wright; but it is hard that Prof. Bonney, who has trained a full generation of geologists in England, and to whom the Alpine heights are as a garden, should be compelled to select his most effective illustrations from those of an American predecessor. A few views of English boulder-clays, and erratics, and *roches moutonnées*, as they actually appear, would have been at least refreshing. Our students know far too little of their own islands; and, in the case of Ireland, such pictures would have been absolutely novel.

On p. 126, "till" is distinguished from "boulder clay,' and Prof. James Geikie is quoted in support of this position; but the reference is to the first or second edition of the "Great Ice Age," since in the third the distinction is abandoned. The third edition is quoted, however, but again without exact specification, on p. 109.

In describing the principal accumulations due to glacial action in our islands, it would be impossible to follow all the literature that has been poured forth in recent years. Prof. Bonney seems to have made a fair and wide selection, perhaps leaving some extreme views charitably alone; throughout, he describes rather than theorises, and follows out, with steady self-denial, the line of work on which he started. From p. 163 to p. 205, we have a discussion of the opinions of other authors; but we read on with a sense that behind all this exposition there is a guiding mind, gently and steadily influencing our own. Yet it seems that no one can complain of having been misrepresented, which is about as much as Prof. Bonney can hope for, when we look back on the amenities of glacial warfare.

The description of the centres of radiation of boulders of various types (pp. 151-161) would be made of singular value to all students, if, in a second edition, a plate showing typical microscopic sections of the rocks referred to could be inserted. In this connection, we note a curious remark in the foot-note on p. 140, where Ailsa Craig is said to be "too small a place to have furnished numerous specimens to such a distant locality." Megascopic and microscopic examination has again and again proved the occurrence of erratics of the Ailsa rock, not that of Mynydd-mawr, as far south as Greystones on the Irish coast, and their existence was thus proved even under Mynydd-mawr itself. The very smallness of Ailsa Craig may surely be adduced in favour of the view that these abundant blocks have been worn away from it. Of course, some of these boulders may have come from the Riebeckite-eurite of Skye; but of this there is as yet no evidence. Here we touch one of the most frequent paradoxes in glacial essays—boulders are assumed to have come from the self-same levels where similar rocks are now exposed. The frequency of the boulders themselves is a fair measure of the former extension of the rock in question, even if we neglect any possible differential earth-movements.

A somewhat startling omission occurs on pp. 200 and 202, where what we may almost style the life-work of Mr. Maxwell H. Close is attributed inadvertently to Prof. Hull. The wide distribution of the "sands and gravels" in Ireland might perhaps have been further emphasised; but the recent observations of Prof. Sollas on Irish eskers find an appropriate place in the concluding sentences of this section.

Chapter iii. of this part goes further afield, particular attention being given to the wide-spread glacial phenomena in North America. And then we find the vexed "Theoretical Questions" summed up in Part III., conveniently shut in by themselves. The concluding words of the chapter dealing with temperature in glacial times again calls attention to the dependence of the successive stages of the cold period upon the variable level of the land; and, similarly, the next chapter on the "causes of a glacial epoch" closes judicially with the statement that probably "some factor which is essential for the complete solution of the problem is as yet undiscovered, or, at any rate, the importance of one which is already known has not been duly recognised."

The final pages of this admirable book, the strength of which lies largely in its reserve, point to a closer study of Greenland as essential to the solution of our problems. Already some comment has been made, through the latest of researches, on the question raised by Prof. Bonney (p. 135) as to the possibility of stratification in the deposits of land-ice. The spirit in which the author has shown how the field is open to the future should now attract a new band of workers, unfettered by their own past utterances.

Critics are most likely to lay hold of the treatment of contemporary literature, when looking for a weakness in this little volume. We have already indicated that the exactitude of a librarian is not always noticeable in the references, and various editions are not separately quoted. On p. 90 the title of Mr. Whymper's book is not precisely given, and the most important reference to the subject is in chapter xvi., not chapter vi.—at any rate, in the last edition. It is not clear from what work a passage on p. 114 is quoted; the reference should be to James Geikie, "Great Ice Age," third edition, p. 171. On p. 139, we might have liked a reference to some of the later literature on Moel Tryfaen, perhaps to Mr. Mellard Reade's examination of the microscopic materials, or to Miss Andrews's record of foraminifera. The difficulty as to the mingling and crossing of erratics borne by land-ice (p. 171) has been to some extent met by an important paper by Prof. Jas. Geikie, published in the *Scottish Naturalist* in 1881, and in "Fragments of Earth-Lore" in 1893. Why, again, are the figures on p. 21 quoted from an abstract in the *Alpine Journal*, and not from Heim's own book? The reference-figure is so placed on the page as to include a calculation which seems really due to Prof. Bonney. And here and there quotations from other authors have not been checked, so that, as they stand, they are not absolutely accurate. The only important case of this kind, however, seems the slip of "shale" for "strata" on p. 70, second line from bottom.

When, in this seemingly trivial manner, we think we have found a plane of weakness in Prof. Bonney's treatment of "Ice-Work Present and Past," it is like pointing out that David, another standard author, was injudicious in discarding the full panoply of armour. The writer of so many voluminous and yet precise papers in our geological journals has again and again protected himself from this attack. He has displayed a generous indifference as to the originality of any statement he may put forth, and has thereby doubtless lost considerable credit which he might otherwise have gained, as well as opportunities for trenchant criticism. "If any one," he wrote in 1890, "has come to conclusions identical with my own, I can assure the author that there is no plagiarism." In 1886, the matter was put still more clearly. "If," Prof. Bonney wrote, "there is any value in my results, it will be that they have been obtained, as far as possible, independently, and sometimes actually in ignorance of the work of others."

This standpoint is heroic, and involves considerable sacrifice of self; the argument has so obviously two sides to it. Is it a wise one to reiterate before us, juniors and pupils as we are; and shall we not remember how in many cases it was from Prof. Bonney that we received our first literary encouragement? Who amongst us, however, shall pose as his critic in this matter? Rather let us ask it of him as a question.

GRENVILLE A. J. COLE.

PHILOSOPHY AND EVOLUTION.

Evolution and Man's Place in Nature. By Henry Calderwood, LL.D., F.R.S.E. Second edition. Pp. xx + 316. (London: Macmillan and Co., 1896.)

IT is not often that the author of a work on science or philosophy so far accepts the verdict of his critics as to entirely re-model and re-write his book. Much to his credit Prof. Calderwood has done this, for the second edition now just issued is not only nearly twice the bulk of the first, but is also full of new matter, and is greatly improved in its scope and arrangement. The first edition (reviewed in NATURE, vol. xlvii. p. 385) contained eight chapters, while the present work has seventeen, the titles and "contents" of which are so different that the two books seem to have little in common. The chapters on "The Nerve System as an Instrument of Knowledge," "Right and Wrong," "Civil Law," "Modern Thought," "The Ape and Man," and "Cosmic Problems," seem to be wholly new and to embody the results of the most recent researches. In other respects the present work is far superior to the former edition, as it not only gives a much larger body of facts, and contains less repetition, but is a more complete presentation of the whole subject, treated from the point of view of philosophy rather than from that of science.

The author's style, which leads him always to go round about a subject rather than to the heart of the problem itself, to take much for granted which requires systematic proof, and to revel in diffuseness of phraseology and of argument, is still a prominent feature, and is wearisome to the reader who wants to get at the author's conclusions and to have a clear presentation of the facts and arguments on which they are founded. But to those who enjoy diffuse philosophical discussion, and especially to those who want a reply to the supposed materialistic tendencies of the works of Darwin and Herbert Spencer, there is here much food for thought. A few passages will serve to illustrate the author's merits as well as his limitations. In the chapter on "Right and Wrong," he thus explains his view of the essential difference between the human and the animal nature.

"The grand distinction of human life is *self-control in the field of action.* Thought not only reaches a generalised knowledge of existence, and of its laws; it leads to rationalised action, within the many and varied fields of human endeavour. The evidence of this appears, as already described, in the control exercised over all the animal impulses, so that these do not spontaneously and of themselves determine activity. Sensibility operates in human life, just as in the life of the animal; but it does not at once direct our action, as the course of the dog is ruled by sense of smell. Sensibility can influence us in the same way, and a similar result is often seen in our life; but that which is peculiar to man is a concentration which overcomes allurements of sense. Animal appetite is stirred in us, as in animals, physiological law being coextensive with the animal kingdom; our speciality appears in the regulation of animal impulse, so that it is repressed, in accordance with the laws of attention, which weaken or strengthen animal propensity; or limited by reference to propriety; or regulated in its indulgence in recognition of a law higher than present desire. These facts are so familiar, that I have only to refer to them to claim their weight of evidence for a power which does not appear in animal life. The value of this evidence will be still more appreciated, if it be observed that the control of animal impulse no more belongs to the animal nature of man, than it belongs to the animals around him. In respect of animal impulse, his experience is as much determined by physiological law, as animals are visibly moved by it. Man being an animal, no one can suggest that the movements of animal impulse are otherwise determined or have their source elsewhere than in the body. The difference between man and animals appears in this, that by thought and imagination passion may be intensified; and by use of these powers it can be restrained. Even within the sphere of passion, the elevation of human life is seen in the control the rational power wields over the animal nature."

The purport of this wordy and laboured passage is clear enough, but its cogency as an argument is certainly not proportioned to its length. The same idea is pursued through two other paragraphs of equal length, but these do not bring any further sense of completeness to the presentation of the subject.

One more extract may be given from the final chapter on "Cosmic Problems."

"With clearest testimony, scientific observation has led us to innumerable points, whence we have seen intelligent purpose at work providing for life yet unborn. We have been arrested first, and afterwards roused to quickened consciousness, realising that we have seen the lesson all the days of our life, in hundreds of forms, but had not read its full meaning, though it had been written large; for is not the whole vegetable kingdom confessedly a preparation for a coming life? In vain does Agnosticism lift its voice in presence of witness such as this. Testimony for an Intelligent cause springs even from the *dust*, and, as it comes thence, thought moves freely along all fields of science, gathering evidence as readily from the vegetable kingdom as from the animal; finding, with ever-increasing surprise, a growing testimony as science conducts us lower in the knowledge of nature. Not to the heights but to the depths we go, in order to witness the most startling condemnation of Agnosticism. It is not merely the myriad dwellers in the insect world which bear witness; but the inanimate creation itself tells us of treasure stored in its keeping, to satisfy animal wants. Plants can manufacture fresh protoplasm out of mineral compounds, whereas animals are obliged to procure it ready made, and hence in the long run depend upon plants. Thus, even from the *soil*, under our feet, comes the evidence calling us to own an Intelligent First Cause."

A number of illustrations, of the lower forms of life, of the sense organs of various classes of animals, and of the brains of many of the mammalia and of man, will render the work more attractive to those who have not acquired a general knowledge of the subject from other sources.

A. R. W.